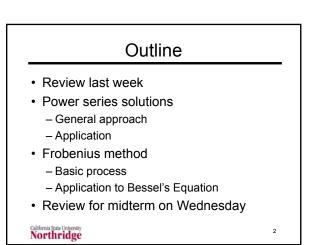
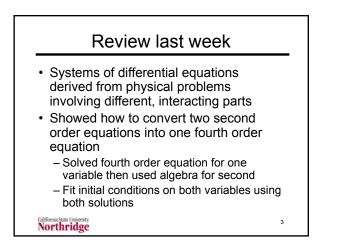
Power Series Solutions and Frobenius method

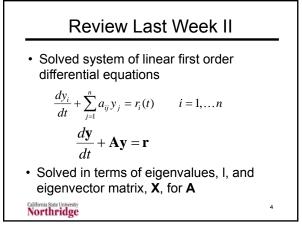
Larry Caretto Mechanical Engineering 501AB Seminar in Engineering Analysis

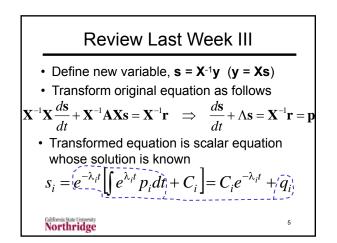
October 16, 2017

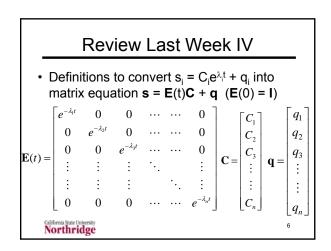
California State University Northridge



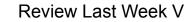








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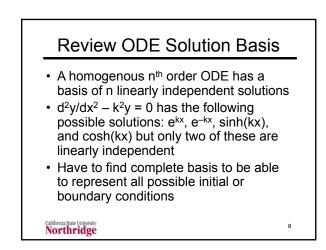


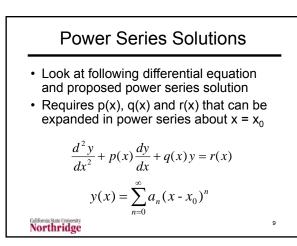
- Convert matrix equation for s into matrix equation for y using y = Xs
- Apply initial condition that $\mathbf{y} = \mathbf{y}_0$ at t = 0, (where $\mathbf{E} = \mathbf{I}$,): $\mathbf{C} = \mathbf{X}^{-1}\mathbf{y}_0 \mathbf{q}_0$

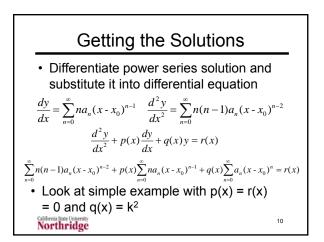
7

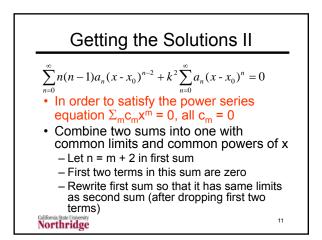
- Result: $\mathbf{y} = \mathbf{X}\mathbf{E} \left[\mathbf{X}^{-1}\mathbf{y}_0 \mathbf{q}_0\right] + \mathbf{X}\mathbf{q}$
- Homogenous (q = 0): y = XEX⁻¹y₀

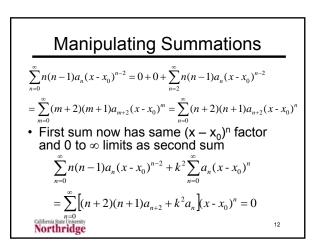
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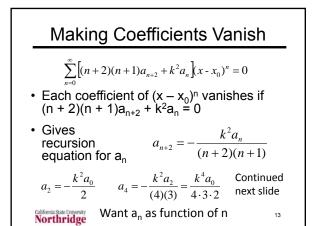


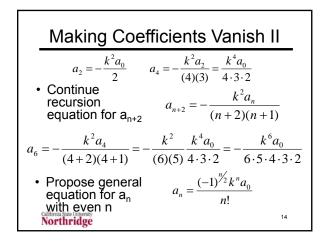


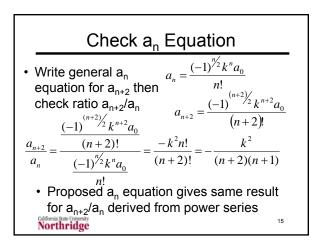


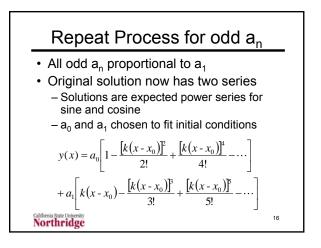


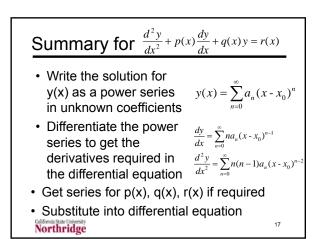


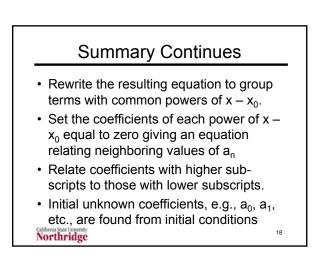


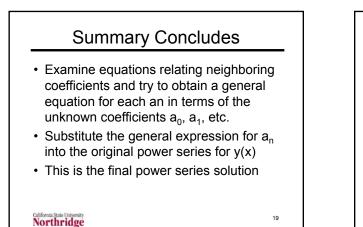


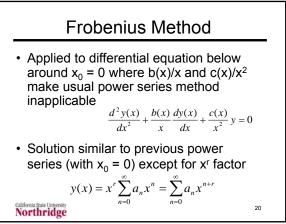


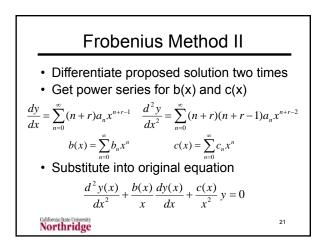


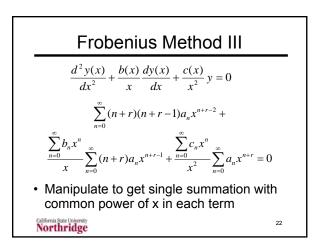


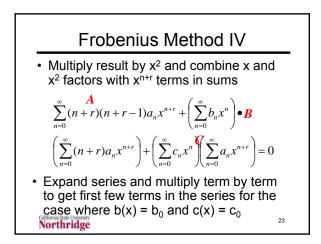


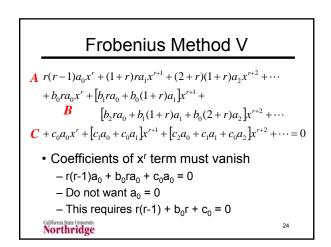


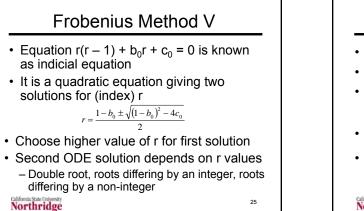


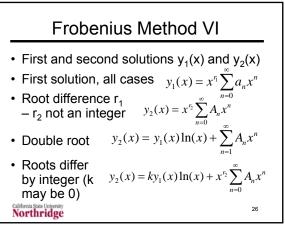


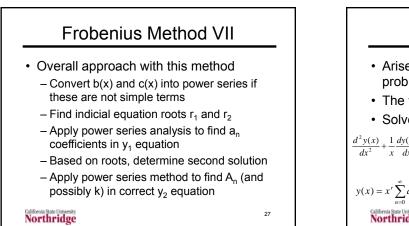


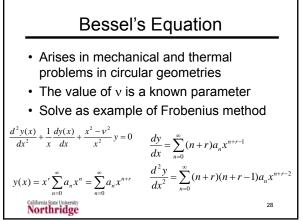


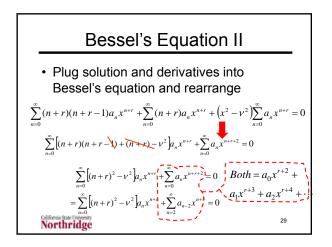


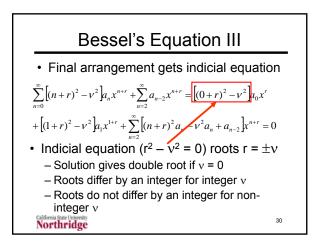








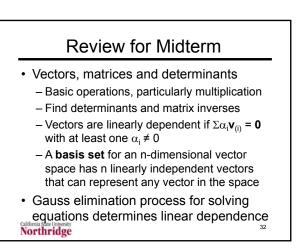


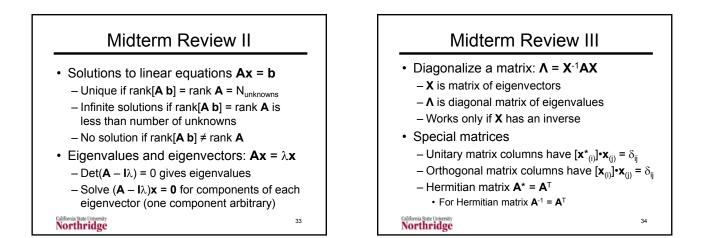


ME 501A Seminar in Engineering Analysis



- · Continue next week after midterm
- Get series solutions for Bessel functions for three cases
 - Double root for v = 0
 - Roots differing by an integer
 - Non-integer roots
- Find two different series for any value of v just like finding sine and cosine series in power series solution for $\frac{d^2y}{dx^2} + k^2y = 0$



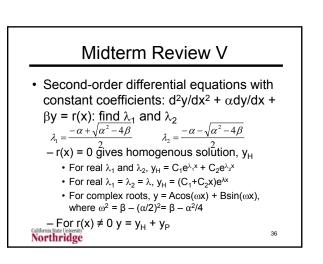




- First-order differential equations
 - Separable forms, e.g. dy/dx = f(x)g(y)
 - General linear equation dy/dx + f(x)y = g(x)has solution $y = e^{p}[C + \int e^{p}g(x)dx]$ where p = $\int f(x)dx$
 - Other separable forms
 - Solutions to dy/dx = f(x,y) exist over a region about x₀ < min(a, b/K) where a,b are is x,y borders and K = max(|f|)

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Unique solution if |∂f/∂x| is bounded
 Northridge



Midterm Review VI

- For nonhomogeneous solutions find solution $y = y_H + y_P$
- To get particular solution, y_P
 - Write form for y_{P} based on form for r(x) Substitute postulated y_{P} with unknown
 - constant(s) into particular equation
 Equate coefficients of like terms to find unknown constants
- Use $y = y_H + y_P$ to find constants from homogenous solution from boundary values Northridge

